

Nitrogen Measurement in Wine

Key Words: Nitrogen testing, ammonia nitrogen, winemaking analysis, nitrogen compounds, Yeast Assimilable Nitrogen (YAN), free alpha-amino nitrogen (FAN), primary amino nitrogen (PAN), fermentation testing

Goal

The following application note explains the importance of nitrogen testing in the winemaking process.

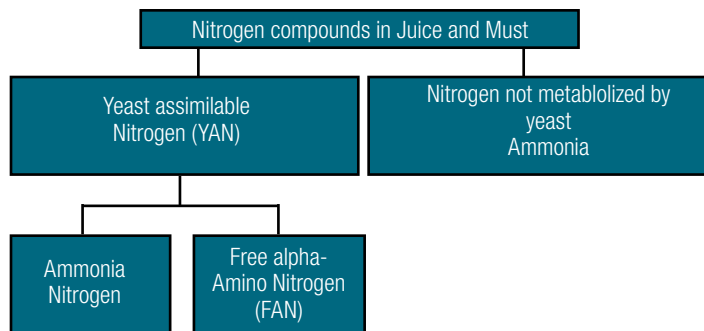
Introduction

Nitrogen is a key nutrient for yeast growth, and is necessary for the successful fermentation of grape juice and must into wine. Nitrogen compounds in juice, must, and wine affect not only the fermentation, but the clarification, aroma, and final chemical composition of the wine. For these reasons, the analysis of nitrogen in the winemaking process is recommended for ensuring a quality wine.

The total nitrogen (N) content of grape juice/must is widely variable. It may be as high as >1000 mg N/L or as low as <50 mg N/L. However, not all nitrogen compounds in juice and must are available for yeast metabolism. The nitrogen that can be used by yeast is known as Yeast Assimilable Nitrogen or YAN. YAN is comprised mostly of ammonia (present as ammonium salts) and certain amino acids, often designated as free alpha-amino nitrogen (FAN¹) or primary amino nitrogen (PAN). Therefore, YAN = ammonia nitrogen + amino nitrogen. The relationship of nitrogen compounds is expressed by Figure 1.



Figure 1.



Testing for Nitrogen

Testing for nitrogen before and during the fermentation is desired. YAN that is too low or too high can have negative impacts on the winemaking process and the wine. Some possible impacts are listed at Figure 2. Decisions on how much and what types of nitrogen to add will be informed by the results of the nitrogen testing.

Methods for Nitrogen Testing

There are several options for nitrogen testing that are available for a wine analysis laboratory. Some tests are for ammonia, or amino nitrogen, and others are for both. Some methods for testing can be done in any laboratory, while others require the advanced instrumentation; typically found in a commercial laboratory. Here is a summary of some of the simpler tests that can be done in most any lab.

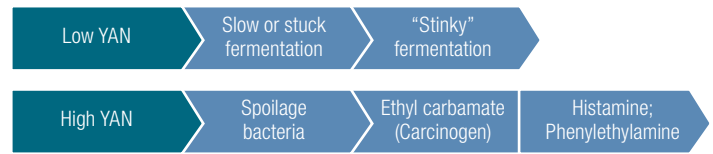


Figure 2.

Equipment Recommendations for Testing

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Methods for Testing Nitrogen

Product	Method	Equipment	Notes
Ammonia nitrogen	Ammonia Ion Selective Electrode (ISE)	pH/ISE meter	No filtration or color removal/blank required. Economical ammonia test option. A pH/ISE meter can also be used for pH, TA ³ , SO ₂ by Ripper/ORP, and potassium, with corresponding electrodes.
	Enzyme	Spectrophotometer or wine analyzer	Can also test for amino acids and other parameters, using different reagents. Initial equipment costs and prepared reagent costs tend to be higher.
Amino nitrogen	NOPA ²	Spectrophotometer	Can also test for ammonia and other parameters, using different reagents. Initial equipment costs and prepared reagent costs tend to be higher.
	Enzymatic	Spectrophotometer or wine analyzer	Can also test for ammonia and other parameters, using different reagents. Initial equipment costs and prepared reagent costs tend to be higher.
YAN	Micro formol titration	pH meter and burette	One test gives both nitrogen forms. Uses small amounts of hazardous formaldehyde. Most economical option.
YAN and TA ³	Micro TA and formol titration ⁴	pH meter and burette	One test gives both nitrogen forms. Uses small amounts of hazardous formaldehyde. Most economical option.

Equipment Recommendations for Testing

Ammonia Nitrogen	Amino Nitrogen +	YAN (and TA)
Thermo Scientific™ Orion Star™ A214 benchtop ⁵ or Star A324 portable pH/ISE meter	Talk to us about Thermo Scientific™ spectrophotometry products	Orion Star™ A211 Benchtop ⁵ or Orion Star A221 portable pH meter
Thermo Scientific™ Orion™ 9512HPBNWP High-Performance Ammonia Electrode	+ Can test for ammonia and other parameters as well	Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ 8172BNWP pH Electrode or Thermo Scientific™ Orion™ GD9156BNWP Green pH Combination Electrode

References

1. In some winegrowing areas, the term FAN is used to indicate free available nitrogen, rather than the term YAN. To avoid confusion, we will use the terms “amino nitrogen” and “ammonia nitrogen” here.
2. Nitrogen by o-phthalaldehyde assay.
3. Titratable Acidity.
4. Combined Titrametric Analysis of TA and YAN, Barry H. Gump, Vitis Research. (bgump@fiu.edu; www.vitisresearch.com).
5. Comes with stirrer capability.

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